USER'S MANUAL

Frontier power -3000

UNINTERRUPTIBLE
POWER
SYSTEM

CROSS T.E.C Co., Ltd.

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1. INTRODUCTION

First of all, we wish to thank each of you whom purchases our premier UPS F3000 RAID of CROSS TEC

The name of Frontier was originated from the key words of our company motto, which is *"We, each and every member of CROSS TEC(www.crossups.com) shall head toward to reach the top in the field as we try together with the original idea and the research investment, firmly based on the concord and the sincerity of our good will"*. Those keywords are Electricity, Sincerity, Concord, Original idea, Research investment, and Top. As expressed in the name of FRONTIER itself, F3000 RAID *UPS system* serves as the guardian of all the sensitive power equipment including computers & telecommunication systems and computerized instruments, and as well as our confident and widely known representative product.

The F3000 RAID

Uninterruptible Power System of CROSS TEC. is a truly advanced 3-phase on-line sine wave UPS which Utilizes new power electronic technology such as Pulse Width Modulation by IGBT(Insulated Gate Bipolar Transistor), and is designed to offer high efficiency, low operational noise, compact size, better reliability, and easy access for maintenance and service to our most valuable customer.

We put all together of our inspiration, intuition, energy, effort, and resources in our premier F3000-*3000 Uninterruptible Power Supply System*.

2. SYSTEM DESCRIPTION

2.1. Foreword

This UPS system facilitates sine wave Pulse Width Modulation which instantaneously controls the waveform to supply the uninterrupted constant voltage and constant frequency balanced 3-phase AC power to the critical load for smooth operation and fortified protection against unstable commercial power failure such as outage, sag, surge, voltage transient, frequency change, flicker, and etc.

2.2. Composition and Functions

The F-3000 system is composed of numerous parts as follows,

- Input Transformer
- Rectifier & Battery Charger
- Inverter
- Output Transformer
- Static Switch
- Control Circuitry
- Digital Display

2.2.1. Input Transformer

This transformer is manufactured as H class dry type. The output voltage is designed to correspond the input voltage of inverter and charging voltage of battery, and the output current, to sufficiently match the sum of the charging current and the rated current of inverter.

2.2.2. Rectifier & Battery Charger

This unit includes the thyristor module, heat dissipation board, and many other components. It will convert input AC power to DC power, supply the inverter, and simultaneously charge the battery with the best condition possible.
Also, the filtering circuit composed of reactor and condenser, is employed to filter out the ripple characteristics contained in the rectified DC power, in order to yield the best possible DC power.

2.2.3. Inverter

This unit contains IGBT (Insulated Gate Bipolar Transistor) module, heat dissipation board, rapid firing fuse for the semi-conductor protection and other relevant component. The high frequency switching and the sine wave Pulse Width Modulation, are utilized in this unit. The inverter will revert the DC power obtained from rectifier to PWM AC output, and then the AC filter will make it very similar to the balanced sinewave AC voltage to supply the critical load.

2.2.4. Output Transformer

The primary lead shall be connected to inverter and the secondary to output in this isolation transformer. It is specially designed to contain the reactance and partially serves as output filter.
Also, it minimizes the current harmonics, and maximizes efficiency. The input and output voltage and frequency are synchronized by phase lock loop oscillator. The synchronized transfer units are placed at the bypass line and at the inverter section.

2.2.5. Static Switch

This unit operates as an automatic transfer device between inverter and bypass feed. At the moment of detection of any abnormal operation in inverter or over-load condition, the static switch will simultaneously transfer the power supply to bypass feed (commercial power), not to interrupt the load operation. When the inverter operation returns to normal, the static switch will then retransfer supply line to inverter, again without any interruption.
In order to avoid the possible rush current evolved from the phase difference, this unit is constituted with only semi-conductors.

2.2.6. Control Circuitry

This unit consists of inverter control, alarming circuit, static switch control, and etc. It is designed to operate though the internal unexpected voltage transient intervenes. Its power comes from the battery by DC/DC converter, and thus, power outage or start-up peak current would not affect the control circuitry operation.

2.2.7. Digital Display

This unit is placed in upper site of front panel for monitoring easiness and displays the followings.

1) Measurement

- AC input voltage, current, & frequency measurement for each phase.
- AC output voltage, current, & frequency measurement for each phase.
- Battery voltage measurement.
- Bypass input voltage, current, & frequency measurement for each phase.

2) Operating condition

- Rectifier in operation (RECT. ON)
- Rectifier out of operation (RECT. OFF)
- Battery equalize charging (EQU.)
- Battery float charging (FLO.)
- Inverter in operation (INV. ON)
- Inverter out of operation (INV. OFF)
- Synchronized operation (SYNC.)
- UPS in normal operation (UPS NORMAL)
- Rectifier abnormal (RECT. ALARM)
- DC line abnormal (DC ALARM)
- Inverter operation abnormal (INV. ALARM)
- Commercial bypass line abnormal (BYPASS ALARM)

3) Control switches

- Circuit breakers (CB1 - CB5)
- Manual Transfer Button
- Lamp Test Button
- Reset Button
- Inverter ON & OFF Button
- Enable Button

2.3. Operation

2.3.1. Normal

The rectifier and charger will get the AC commercial power and convert it to DC, and then, send it to inverter for the reverse to AC and to battery for charging. The filtered AC power from inverter will be supplied to the load without interruption.

2.3.2. Power Outage

When commercial power fails, the battery starts to let out the reserved DC power to inverter and it continues to feed the load during the power outage for the defined time period.

2.3.3. Power Recovery

When the commercial power is recovered, the battery stops to feed and starts to recharge. At the same time, the commercial power passes through the normal routine.

2.3.4. Internal Failure & Over-load

The output voltage and frequency of inverter are synchronized with the commercial power supply at all times. Thus, in case of internal failure or over-load, the static switch transfers power to bypass feed and the synchronized power is constantly fed to the load.

FOR THE ELECTRICAL CHARACTERISTICS ON PAGE 7.

INPUT VOLTAGE, OUTPUT VOLTAGE, BATTERY TYPE, CAPACITY (BACK -UP TIME), QUANTITY, SHALL BE SPECIFIED AT TIME OF PURCHASE.

* : When power outage, input power varies, or 0-100% load changes.
** : At rated input/output, and rated load.
*** : Control circuits, semi-conductors, condensers, and noise filters are excepted.
**** : When measured from 1.5m away, and 1.5m high.

2.4. Electrical Characteristics

TYPE			FP 3000 RAID
CAPACITY (KVA)			
GENERAL	COOLING MEYHOD		Forced Air Cooling
	OPERATION		100% Continuous
	RECT. & CHRG.	CONTROL	6 Phase Full-Bridge Controlling
		SEMI-CONDUCTOR	Thyristor
	INVERTER CONTROL		Instantaneous Sine Wave PWM by IGBT (Individual Phase Controlling)
	ST/SW TRANSFER		Automatic Synchronized Power Transfer by Semi-Conductor
	TRANSFORMER		H Class
INPUT	No. OF PHASE		3 4 W
	RATED VOLTAGE		380V
	VOLTAGE VARIATION		Rated Voltage 10%
	RATED FREQUENCY		60 Hz 5%
OUTPUT	No. OF PHASE		3 4 W
	RATED VOLTAGE		380V
	VOLTAGE STABILITY		Within 2%
	RATED FREQUENCY		60 Hz 0.5 Hz
	* VOLTAGE REGULATION		Within 5%
	* RESPONSE TIME		Less Than 20mS
	VOLTAGE ADJUSTMENT		Over 5%
	WAVEFORM DISTORTION		Less than THD 3% (100% Linear Load)
	OVER-LOAD CAPACITY		120%, 10 Minutes
	POWER FACTOR		0.8 Lag.
**** AUDIBLE NOISE			60 dBA
** TOTAL EFFICIENCY			Over 87%
STATIC TRANSFER	TRANSFER TIME		Less than 4mS
	TRANSFER CONDITION		o INVERTER FAILURE o OVER-LOAD o DC LOW VOLTAGE o MANUAL TRANSFER
DC POWER	RATED VOLTAGE		240V
	MAXIMUM VOLTAGE		270V
	MINIMUM VOLTAGE		210V
INSUL- ATION	*** WITHSTAND VOLTAGE		AC 1500V, 60Hz for 1 Minute
	*** INSULATION RESISTANCE		With DC 500V Megger, Over 5M
TEMP. RISE	TRANSFORMERS		Below 140 Degree
	SEMI-CONDUCTORS		Below 80 Degree
COLOR (CASE COATING)			5 Y 7/1 (in Munsell No.)

3. DELIVERY & INSTALLATION

3.1. Delivery

3.1.1. Advice

When delivering the UPS, the weight lifter of more capacity than the UPS's weight is necessary and it should be applied to the bottom support of UPS or the bottom part of the container. Also, the equipment should not be neither shaken nor vibrated. If forced by nature, avoid the inclination of the equipment more than 15 from the horizon.

3.1.2. Shipment inspection

- Inspect the delivered equipment in detail for any missing part or any visible damage. If found any, notify CROSS T.E.Co. immediately.

- Never apply any sharp edged material or tool to the equipment.

- Avoid any form of physical shock to the equipment.It may cause the malfunction of the system.

3.1.3. Storage Before Installation

Before installation, the UPS needs to be stored in a protected place from humidity, dust and other damaging factors to the system performance.

3.2. INSTALLATION

3.2.1. Condition for installation

- Ambient Temperature : 0 C - 40 C
- Relative Humidity : Below 95% Non-Condensing
- Operating Altitude : Up to 1000m above sea level

Note: This equipment is designed for indoor usage. Avoid installation where exposed to rain, wind, direct sunlight, heat, and other damaging factor.

3.2.2. Pre-installation Requirement

All the circuitry and the control panel are very delicate parts.
Hence, the careful handling is required. Sufficient space (about 20cm distance) is necessary for the ventilation intake and outlet which are placed in front and back of the equipment for air cooling.

3.2.3. Connection of Power

First of all, the size of the cable needs to be calculated according to the necessary capacity of current, and then ensure the position where the cables are connected. Make sure that all the circuit breakers are at "OFF" position, and rearrange the input transformer wiring, as appropriate, depending on AC input power. After completing the wiring of input cables to the relevant terminal, battery cables need to be connected as well with enough care and concern about the positive and the negative cables.

Note: All the connections are to be made FIRM.

4. OPERATION PROCEDURE

4.1. Preoperational Requirement

4.1.1. Before starting the operation of the system, the operator (or whoever wants to instruct the machine) is supposed to obtain enough information and knowledge about start-up, shut-off, repair, routine check, maintenance, and all other relevant system operation.

4.1.2. Make sure that cables are all at the appropriate places.

4.1.3. During the maintenance, if the UPS needs to be stopped, check and ensure that the power is disconnected at least at the service required section, in order to avoid the possible an electric shock.

4.2. Preparations

4.2.1. Check and verify that the input circuit breaker(CB1) and the output circuit breaker(CB3) are in "OFF" position.

4.2.2. Check and verify that all the connectors and the circuit boards are at

the right place, and the connections are firmly done.

4.3. Operational Procedure

Watch carefully for the front display panel throughout the procedure.

4.3.1. When all the circuit breakers are in "OFF" position, turn "ON" the input circuit breaker(CB1).
(As the consequence of this action, RECT. ON, INV. OFF, INV. ALARM, BYPASS ALARM LEDs will light "ON".)

* In order to clear any alarm status indication, PRESS "RESET" button of selection switch section right side of front display panel.
(When any alarm condition is cleared, the UPS NORMAL LED will light "ON".)

4.3.2. Turn the battery circuit breaker (CB2) "ON".
(According to the amount of charging current detection, FLO. LED or EQU. LED will light "ON".)

4.3.3. PRESS "ON" button and "ENABLE" button simultaneously for the INVERTER operation.
(In several seconds, INVERTER will softly start its operation, and the static switch will start to synchronize the inverter output frequency and that of bypass commercial power. At this moment, the INV. OFF LED will be "OFF", and the INV. ON and SYNC. LED will light "ON".)

4.3.4. Turn "ON" the bypass circuit breaker (CB4), so when the inverter operation is interrupted, it can be transferred to the commercial bypass line.

4.3.5. Turn on the output circuit breaker(CB3) in order to feed the load.

Note: The EMERGENCY circuit breaker (CB5) shall be in "OFF" position during the INVERTER operation.

------ WARNING ----------

BEFORE turning on the output circuit breaker(CB3), operation of UPS MUST be done. NOT CB3 then UPS. If done incorrectly, it may damage the load equipment and the system itself.

4.4. Ending Operation Procedure

4.4.1. Turn off any load fed from UPS, in order to separate the load and UPS, and then turn the output circuit breaker (CB3) "OFF".

4.4.2. PRESS "OFF" button and "ENABLE" button switch together to halt the INVERTER operation and to transfer to bypass mode.

4.4.3. Turn "OFF" the battery circuit breaker (CB2).

4.4.4. Turn "OFF" the bypass circuit breaker (CB4).

4.4.5. Turn "OFF" the input circuit breaker(CB1) to stop the system operation.

4.5. Emergency Operation

If system must supply the power to the load, even though the inverter behaves in abnormal way, PRESS "OFF" and "ENABLE" button switch to transfer to bypass feed from inverter operation.
If worse gets worst and the bypass feed is impossible, TURN the EMERGENCY circuit breaker (CB5) "ON" for the direct commercial power, and inform ASEA E&T Co. for service as soon as possible.

5. MAINTENANCE & SERVICE

5.1. Maintenance & Service

------- *WARNING* ----------

There are no customer servicable units inside.
DO NOT open the cover and attempt to fix the unit. High voltage may remain when the equipment is shut-off. The unauthorized service or attempt will void the warranty and could cause the serious injury and the costly damage.

The possible causes for the abnormal operation of UPS, are as follows;

5.1.1. Input power out of operational range.
5.1.2. Over-load out of operational range.
5.1.3. Ambient(surrounding) condition out of operational range.
5.1.4. Misuse.
5.1.5. Component failure.
5.1.6. etc.

5.2. Handling

The static UPS shall be treated and used as a delicate and sensitive equipment like computer systems. At all times, adequate operational environment shall be maintained such as ambient temperature of below 40 C, clean air, sufficient ventilation, and so on.

5.3. Display Panel Reading

Periodically, checking and inspection of display panel reading is highly recommended. It may offer the clues of future problem and may provide the possible preparations of foreseen disaster.
Also, it is advised to read the display panel after any change was made to the load, input, and operation of the system.

Table #1 : SELECTION SWITCHES (Right side of display).

CATEGORY	DESCRIPTION	REMARK
INPUT	To select the input power condition.	White
BATT.	To select the battery power condition.	"
OUTPUT	To select the output power condition.	"
BYPASS	To select the commercial power condition.	"
V	To check the volatge measurement.	"
A	To check the current measurement.	"
F	To check the frequency measurement.	"
A	To select the power condition of phase R.	"
B	To select the power condition of phase S.	"
C	To select the power condition of phase T.	"
ON	To start the INVERTER operation. (together with "ENABLE" button)	Green
OFF	To stop the INVERTER operation. (together with "ENABLE" button)	Red
LAMP TEST	To check the LED lamp operation.	White
RESET	To clear the alarm state.	Blue-Green
MANUAL TRANSFER	To transfer to bypass mode manually. (together with "ENABLE" button)	White
ENABLE	To start or stop the INVERTER operation. (together with "ON", "OFF", or "MANUAL TRANSFER" button)	"

Table #2 : STATUS & SYSTEM OPERATION DIAGRAM.

CATEGORY	DESCRIPTION	REMARK
AC INPUT LED		
BYPASS INPUT LED	Input Voltage measurement	Green LED
BATTERY LED	Input Current measurement	"
INV. LED	Output Voltage measurement	"
AC OUTPUT LED	Output Current measurement	"
BYPASS ON LED	Output Frequency measurement	"
RECT. ON	Battery Voltage measurement	"
RECT. OFF	Digital Meter for each measurement	Center part of Display Panel
EQU.	Audible alarm along with Fault LED.	Refer to Electrical Characteristics.
FLO.		
INV. ON		
INV. OFF		
SYNC.		
UPS NORMAL		
RECT. ALARM		
DC ALARM		
INV. ALARM		
BYPASS ALARM		
METER		

5.4. Battery Maintenance

The battery employed in our UPS system is a maintenance free type, and thus, it requires no periodic check-up. But, it is recommended to test the battery discharging capability and the cable connection from time to time for optimum performance.

5.5. Operational Record

Our UPS system is designed for easy maintenance and very little customer maintenance is required. It is advisible to record the operational behavior in routine bases for smooth operation and easy service, if necessary.

CATEGORY	DESCRIPTION	REMARK
ANY DAMAGE		
ALARMING CONDITION		
LED INDICATIONS & CIRCUIT BREAKERS STATUS		
LOAD CONDITION		
REPLACEMENT		
OTHER		

5.6. Inspection of overall operation of system

Inspection of all component in detail is required more than twice a year.

5.6.1. Deterioration of component performance.

5.6.2. Looseness of all connection.

5.6.3. Change in set-values.

5.7. Status and alarm indication

STATUS					CONDITION	SOLUTION
INPUT LINE	INVERTER ON	BYPASS ON	FAULT	BUZZER		
ON	ON	-	-	-	Normal	
-	ON	-	-	Every 4 sec.	Normal, Power Outage	
-	ON	-	-	Every 1 sec.	Normal, Battery Discharge	
ON	ON	-	-	Every 4 sec.	Rect. Abnormal	Call for Service
ON	-	ON	-	-	1. UPS Stopped.	PRESS "ON" Push Button
					2. OVER-LOAD	Refer to Troubleshooting Guide.
-	-	-	ON	Continuous	Power Outage & Battery Over-Discharge	PRESS "OFF" Push Button
ON	-	ON	ON	"	Inverter Failure	Refer to Troubleshooting Guide.

5.8. Troubleshooting

TROUBLE	CAUSE	SOLUTION
INPUT LINE & BYPASS ON LEDs are "ON".	1. INVERTER is not in operation.	1. Start the INVERTER operation by PRESSING "ON" Button.
	2. OVER-LOAD	1. REDUCE some load. 2. If no change, call for service.
INPUT LINE LED is "OFF" & Alarm sounds periodically.	POWER OUTAGE	1. Check the Power source. 2. If the power source is normal, call for service.
FAULT LED is "ON" & Alarm sounds continuously.	1. INPUT & BYPASS LEDs are "ON".	1. PRESS "OFF/RESET" Button, and then "ON" Button. 2. If no change, call for service.
	2. INPUT LINE LED is "OFF"	1. Possibly, battery cut-off. 2. If the power recovers, PRESS "OFF/RESET" Button. 3. If no change, call for service.
When power outage, no output from UPS.	Battery Over-Dischrged (Shutdown)	1. If the power recovers, turn the input CB "ON" and recharge the battery for at least 6 hours. 2. If no change after charging and then discharging, call for service.
INPUT LINE & INV. ON LEDs are "ON", and Alarm sounds.	RECT. ABNORMAL	call for service.
All LEDs are "OFF" as well as alarm.	OUTPUT SHORT	1. REMOVE the load from UPS. 2. CHECK the fuse. Replace it if blown. 3. RESTART UPS. If no change, call for service.

6. LIMITED WARRANTY

Our premier Frontier Power 3000 RAID UPS system is warranted against all defectes in workmanship and material under normal use for the period of 1 year from the date of initial operation by our serviceman to the original user.
The condition of this warranty and the extent of the responsibility of ASEA E&T Co. under this warranty as follows;

- The warranty does not apply if the product has been subjected to physical abuse, improper installation, unauthorized service, or modification.

- If it becomes necessary to send a defecting unit to CROSS T.E.Co., the product shall be shipped in its original package or with adequate protection, and the shipping charges shall be prepaid.CROSS T.E.Co., will not assume any responsibility for any loss or damage incurred during shipping.

- CROSS T.E.CO. shall not be liable for any damage arising from the use or misuse of this product.

Note: Any unauthorized repair or attempt will void the warranty in any case, in any situation. Hence, If any problem is found during the system operation, it is highly advised to inform CROSS T.E.Co.,or the relevant department as urgent as possible.